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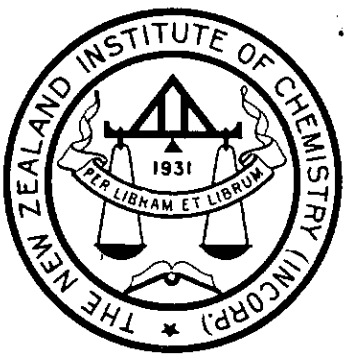

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EDITORIAL.

New Zealand chemistry will be well represented by Sir Theodore Rigg and Dr. F. G. Soper at the forthcoming Empire Conference on Research. The findings of any such conference, insofar as they bear on New Zealand problems must finally be implemented here. Hence we strongly recommend to members of the Institute, the appeal Dr. Melville makes in a letter published below, that his paper on biological products in relation to chemical industry, should be critically studied by those with special knowledge. His desire to develop from it, with the help of such criticism, a fuller and more detailed report, is worthy of all the support which can be given. While comment would be better sent direct to the Plant Chemistry laboratory, we will be happy to collaborate by publishing material which members feel will benefit by wide discussion.

The newly founded New Zealand University Press appeals elsewhere in this issue for suitable manuscripts which will be considered for publication. The publishing of works of scholarship and research is a very proper function of a University, and we welcome this evidence of progress in an institution of which a high proportion of our members are graduates. New Zealand chemistry has surely come of age and we may hope that those who practice it will not be behind their fellow students of other disciplines in contributing their share to a steady flow of publications.

ROYAL SOCIETY EMPIRE CONFERENCE

London, June 17th — July 8th, 1946.

The Editor,

Sir,

The following article is one of a series prepared for the Royal Society's Empire Conference to be held in London during June, 1946. The Conference has the rather ambitious aim of co-ordinating scientific research on an Empire basis and in order that discussions should be on a thoroughly practical basis the Royal Society asked each of the Dominions to supply a

series of reports on a wide variety of topics which would be circulated well in advance of the Conference.

Unfortunately the time available for the preparation of these papers was less than two weeks and I realised that insofar as my contribution was concerned, two weeks was far too short a period in which to repair the deficiencies in my knowledge of the actual or potential chemical industries of New Zealand. But even though the finished product as set out below falls short of the standard required of it, I also realised that it could be made of value to a number of people if the various sections were modified, enlarged or curtailed by the constructive criticism of chemists with particular knowledge in one or other of the subjects discussed. Quite the best way of obtaining such criticism is through your Journal and I request the publication of so relatively lengthy an article solely for that purpose. If members of the Institute, particularly those with specialised knowledge, who feel that underemphasis or overemphasis has been given to a particular topic, that important topics have been omitted, that trivial ones have been introduced or that faulty inferences have been drawn, would write either to you or to me, I feel that I could change the present article from its present form to an authoritative statement of the role which is being and could be played by a certain section of chemical industry in the country's economy. The statement would be too late to fulfil its prime purpose but should be of interest not only to members of the Institute but to individuals and bodies outside it.

I am, etc.

J. MELVILLE.

Plant Chemistry Laboratory,
Box 16,
PALMERSTON NORTH.

THE NATURAL PRODUCTS (BIOLOGICAL) OF NEW ZEALAND AND THE CHEMICAL INDUSTRIES THAT ARE OR MIGHT BE BASED ON THEM.

The dependence of New Zealand's prosperity on her pastoral industry with its very limited range of exportable primary produce has been stressed by all students of her economy and is dealt with in some detail in the first paper of this series. In any discussion therefore of her natural biological resources, the value of her sheep and cattle populations and of the pastures which support them completely overshadows that of any other product. It is natural also that in the desire to improve her primary industry and the secondary industries directly dependent on it, investigation has been almost entirely directed along the lines of increasing efficiency in these industries to the exclusion of work on products of less immediate or only potential value. This policy has un-

questionably paid dividends in the past; its continuation in a world which has of necessity been forced to use substitute materials in the shape of synthetic fibres and margarine may not have the same effect.

It is necessary before discussing chemical industries centring round natural products to state one fact which must always be considered in discussing every industry in New Zealand. The cost of labour is high while the population and hence internal demand for any product is low. For any industry other than one designed to meet only internal demand and capable of insulation from the effect of world price levels, some especially favourable factor must operate in order that its product may compete in the world market. It may be in the cheapness and easy availability of the raw materials, in the high potency of the raw materials, in sheer technical efficiency or in a mixture of all these. But where the cost of labour represents a high proportion of the added value of the final product, the prospects of successful competition in the open market are not great.

This paper will deal first with those industries established in New Zealand which are directly connected with her primary industry in relation to existing or possible chemical industry; and second with other natural products which are peculiar to New Zealand or which though not peculiar to New Zealand have potentialities for economic exploitation.

1. Dairy Industry.

Butter and cheese account for over 50% of the value of New Zealand's total exports. Although the present efficiency of the processing industries is due in considerable measure to an increasing use of scientific, and particularly chemical methods in manufacture and control of the final product, they can in no sense be termed chemical industries. Attention must therefore be directed to the by-products of butter and cheese manufacture, viz. skim milk and whey, and their utilisation for special purposes. In this regard the seasonal nature of milk production must be emphasised since no manufacturing process based on milk can have continuity of supply of raw material.

1. (1) **Dried Skim Milk.** Not more than 5% of the total skim milk produced in New Zealand is dried, the remainder being fed almost entirely to pigs. The efficiency of conversion of milk solids into pig flesh is low and the difference between milk ingested and meat produced is greater, in terms of protein alone, than New Zealand's total export of lamb and cheese. The problem, which is dealt with in the first paper in this series, is largely an economic one and is mentioned here to emphasise that an enormous waste of high grade protein occurs. The technical problems are connected with marketing in areas of low purchasing power, with the best methods of addition to the protein-poor diets of such areas and with methods of dehydration and storage which will allow of entirely satisfactory re-constitution.

1. (2) **Dried Whey.** The losses in whey are considerably less than those of skim milk, but again uneconomic utilisation leads to a large overall loss of high grade protein.

1. (3) **Lactose.** The production of lactose in New Zealand has continued with some vicissitudes for over 30 years, the present prospects being at least as bright as at any time in the history of the industry. The world market for lactose, largely due to the demand of penicillin manufacturers, has expanded markedly during the past 3 years. Assuming a yield of 10,000 units of penicillin per 3 g. of lactose, a production of 600,000 million units per month involves a lactose consumption of over 2,000 tons annually, a figure which is to be compared with an estimated total pre-war production of a little over 4,000 tons.

The New Zealand process, which consists in evaporating whole whey

under conditions causing a minimum of protein change followed by direct crystallisation of the lactose, is technically efficient and the processing plants are favourably situated for the collection of the raw material. As a result it more than holds its own in the world markets. A considerable extension of the present facilities is already under way and the 1945 production figure of just over 1,000 tons will be greatly increased. It is noteworthy however, that 1,000 tons of lactose is produced by only a small fraction of the country's whey production.

The concentrated mother liquors containing the soluble milk proteins, some lactose, lactic acid, mineral salts and accessory substances such as riboflavin are disposed of almost entirely as stock food. Although a considerable amount of work has been done towards a more economic utilisation, nothing really promising has emerged. The recovery of lactic acid either as calcium lactate for export or as free acid for the internal market is technically practicable; the problem is primarily an economic one. A relatively large quantity of orotic acid has been produced by pilot scale process but no market has been found to date. The commercial synthesis of riboflavin has made its separation from whey mother liquors uneconomic.

The conversion of globular into fibrous proteins as has been accomplished with egg albumin by workers at the Western Regional Laboratories of the U.S. Department of Agriculture, is still a long way from providing a competitor in the field of synthetic fibres. If however success is attained, investigation of the soluble whey proteins as they exist in the mother liquors would be warranted.

1. (4) **Casein.** Casein has been manufactured by the acid process for some years, being precipitated from skim milk by the lactic acid produced by fermentation of lactose. No rennet casein is produced. The process is technically efficient and during the war years the demand has been much greater than the supply which last year amounted to just over 1,000 tons. About 75% of the output was exported. Production is strictly controlled due to the demand for pig meat by the United Kingdom and the consequent necessity for the retention by the farmer of nearly all his skim milk.

The postwar outlook is reasonably good although there is a constant threat from synthetic resins and plastics. Casein is likely to hold its own as an adhesive particularly for laminated plywood, there is a small but increasing internal demand from paint manufacturers while there is a field for some expansion in casein plastics.

The successful utilisation of casein whey presents practically the same problems as is presented by cheese whey. It is used at present as pig food, and the efficiency of utilisation is low.

2. Meat Industry.

The by products of the meat industry play a major role in its economy, and their utilisation by any factory makes all the difference between profit and loss. Those by products which are of interest in this discussion are considered below.

2. (1) **Rennet.** Production of rennet started in 1918 and the industry is firmly established. It produces sufficient rennet to cover New Zealand's total requirements at a price considerably below world prices, and it appears that a profitable export market could be developed. The future of the industry depends on the cheese industry as the market for its products, and on the bobby calf industry, which supplies the raw material. Both are flourishing and the prospects in the postwar period are encouraging.

2. (2) **Leather and Hides.** By far the greater part of the skins produced in New Zealand are exported as such. The balance remaining in the country forms the basis of the tanning industry and is the source

of practically all the leather goods sold in New Zealand. The industry suffers from the disability that with the exception of lime all the materials required in fellmongering and tanning have to be imported. Export of finished and semi-finished products represent a tiny proportion of production, and current economic policy furnishes the industry with an assured internal market.

2. (3) **Gelatin.** A sound industry is operating and there are apparently few difficulties. The supply of raw materials is of course excellent.

2. (4) **Glandular Products.** On numerous occasions the utilisation of endocrine glands, particularly the pancreas and the pituitary, for the preparation of hormones has been suggested, but no factory has set up a plant for this purpose. The difficulty of dissecting out the glands is obviously not the major problem since considerable quantities of whole glands are shipped in the frozen state to England for processing. It is certain that even under these conditions major losses of potency occur and a strong case can be made for the processing of the glands here. At present assay presents a problem since no laboratory in New Zealand has the facilities for routine biological testing of hormone preparations. Less important are the relative smallness of factories and their distances apart.

The situation is by no means clear but preliminary work that was done under the stimulus of war conditions indicates that particularly for the pituitary, a much fuller investigation is entirely justified.

2. (5) **Blood Fractions.** The intensive effort which was expended on the fractionation of human blood during the war has resulted in a great increase in our knowledge of the various constituents of the plasma. Although American work indicates that no protein fraction can be safely used for transfusion purposes, there can be no doubt that our increase in knowledge of blood chemistry will be utilised along other than therapeutic lines. The more economic use of blood than its conversion into fertiliser is obviously a major piece of investigation but it is one in which New Zealand, with an estimated production of over 8 million pounds of blood solids, is particularly interested.

3. Wool Industry.

Since the whole question of fibres of animal and vegetable origin is considered in a paper for the evening discussions the topic is introduced for record. The possibility of degrading and re-spinning low grade and waste wool into a uniform product of higher quality will doubtless receive the attention it deserves.

3. (1) **Wool Wax.** The disposal of wool wax is one of the most troublesome problems facing woollen manufactures, and although the problem is greater for Great Britain, Australia and South Africa than it is for New Zealand a solution is urgently required here also. Little systematic work has been done on the problem, but a profitable outlet for the 3¼ million pounds of wool wax produced in this country would make such an investigation desirable.

4. Marine Products.

4. (1) **Fish Liver Oil.** It is doubtful if the present flourishing industry would have been developed but for the war and the acute world shortage of vitamin A. A preliminary investigation dating from 1934 and utilising livers from the fishing industry showed that certain of our larger edible fish gave oils of high vitamin A potency. A small industry based on the normal fishing industry produced some oil for export up till 1938, when a falling price level caused its disappearance. By 1940 however it had been established that there exists in the waters round New Zealand relatively large numbers of sharks and game fish with consistently high oil yields and Vitamin A potencies. During the past 3 years a highly successful industry has been established with two independent

firms operating in Auckland and Wellington respectively. The Wellington factory draws its supplies largely from the fishing fleets while the Auckland one processes livers from school sharks (**Galeorhinus australis**) some of which are obtained incidentally from the ordinary fishing fleet but with the majority coming from vessels chartered for the purpose. Present annual production for both factories is in excess of 25,000 gallons with an average potency for the Auckland factory of 30,000 I.U. per gram. It is estimated that present production is equivalent to over 500,000 gallons of cod liver oil.

Another almost untapped source of even higher potencies is the so called swordfish (**Makaira** spp.) which exists in large numbers off the northern coast. Values of 320,000 I.U. per gram have been obtained and make swordfishing a potentially valuable industry.

Even on conservative estimates the industry is in a flourishing condition and the present capacity is little more than enough to cover export contracts for the next five years. It appears to be well equipped to compete on the world markets with oil from any other source under peacetime conditions.

Research is required along two main lines—biological and chemical. Comparatively little is known of the ecology of the fishes mentioned and a rational conservation policy based on such a study is obviously required. At the moment the raw materials are in good supply but this situation could easily change if reckless utilisation methods are practised. Considerable chemical investigation on the distribution and form of vitamin A within the liver is desirable in order to increase the efficiency of extraction. The preparation of concentrates by molecular distillation would ensure that full advantage could be taken of the sharp price gradients per unit of vitamin for oils of increasing potency.

4. (2) **Agar.** In common with other countries New Zealand found herself cut off in 1941 from her supplies of agar for both bacteriological work and for certain canning processes. In anticipation of this a survey of red seaweeds was made during the period 1939-41 and it was found that there exists extensive fields of easily accessible material largely **Pterocladia lucida**, which gives satisfactory yields of high quality agar. Commercial production was undertaken by a firm engaged in gelatin manufacture and the industry is well established. Collection is done almost entirely by Maoris who are paid a flat rate of 1/- per lb. of dried weed and has proved a considerable source of income for coastal communities in the North Island. In 1943, the first fully operational year, collections of dry weed amounted to 73 tons.

The future of the industry is not so clear cut as is that of fish liver oil but is fairly bright. The wartime price of 25/- per lb. is five times that of pre-war Japanese agar but against that must be considered the higher gel. strength, easier handling and superior clarity of the New Zealand product. Much will depend on the rate of regeneration of the Japanese industry and the premium which is offered for quality. Raw materials are in good supply, collection is a relatively easy matter and the rate of regeneration of the weed is quite satisfactory.

4. (3) **Alginic Acid.** Alginic acid as a valuable addition to the range of synthetic fibres has attracted considerable attention during the war years. A recent survey of **Macrocystis** on the New Zealand coasts shows that an annual harvest of about 4,000 tons of dry kelp from Cook Strait area alone at an estimated cost of £10 per ton may be reasonably achieved. No exploratory work has been done on processing, but the potentialities of alginic acid are so great that a considerable effort in this direction appears justified.

4. (4) **The Whaling Industry.** The New Zealand whaling industry based on Cook Strait is but a shadow of its former self, but it may be

assumed that the extensive industry based on Sub-Antarctica will be resumed after the war. The companies now operating are interested primarily in oil, but some investigation of other by products particularly the endocrine glands, is considered justifiable.

5. Other natural products.

5. (1) **Forest products.** The more economic utilisation of timber has been exercising the timber producing countries of the world for many years. It is a problem of considerable importance to New Zealand since she is particularly well equipped by climate and soil for the rapid growth of a variety of timber trees. Her exotic forests now total over a million acres and can be greatly extended on land which is sub-marginal with respect to her pastoral industry. Pulping of these forests has begun on a big scale and the industry partly because of favourable conditions during the past six years is well established. It is considered that if the by products of the timber and pulping industries could be efficiently utilised the possibility would exist for a much needed diversification of our production with a consequent increase in our economic stability. The problem is a technical one and it is important enough to justify considerable expenditures on research work, both for a research unit within New Zealand and in co-operation with other timber producing and timber processing countries.

5. (2) **Phormium Industry.** The New Zealand Flax, **Phormium tenax**, is practically the only indigenous plant on which an industry has been based, but its history is a chequered one. Phormium fibre has to compete in the world market with the similar type fibres, manila and sisal, for cordage manufacture, and its competitors have the advantage of cheap labour and better organisation. Investigations of the plant and of its fibre have been sporadic and no systematic or concentrated attack on the chemical phases of the problem have been made. In view of the natural advantages possessed by the plant in high fibre yield per acre and per unit of green weight of the leaf, such an investigation is fully warranted. Taken in conjunction with the breeding and selection work which is now well established the phormium industry could become a valuable asset.

Utilisation of phormium fibre for the rayon industry does not appear practicable but it can be used for the manufacture of high grade paper. Here again the problem is largely one of economics.

5. (3) **Nicotine.** Insufficient tobacco is grown in New Zealand to supply her needs, but even this small industry provides enough waste material to make the separation of nicotine an economic process. The technical difficulties have been largely overcome and there seems no reason why about half of New Zealand's requirement of nicotine should not be obtained from locally grown tobacco.

5. (4) **Medicinal Plants.** During the war small areas of **Digitalis purpurea, Datura Stramonium, Belladonna** and **Hyoscyamus** were grown for the internal market, and the venture was successful both in making up the internal deficit and in supplying the English market. Leaf of excellent quality was obtained and preliminary experiments in breeding and selection indicated that considerable improvements in strain could be accomplished, while processing of the leaf presented no major difficulties. The peacetime success of the industry would depend on its ability to compete on the world market, since the internal demand would probably not support an economic unit. The situation therefore resembles that of the agar industry with the exception that plant breeding methods could be used with effect. It is considered that an investigation leading to an accurate estimation of cost of finished product would be justified, since enquiries about further supplies of New Zealand leaf have been received from both English and Australian firms.

CONFERENCE, 1946.

The Joint Annual Conference of the two Institutes of Chemistry will be held in Wellington from Tuesday, August 27th to Friday, August 30th, 1946.

The tentative programme is set out as follows. Unless otherwise stated Morning Sessions are from 9.30 — 12.30 and Afternoon Sessions from 2 p.m. to 5 p.m.

Aug. 27th.	Morning:	Morning Tea & Welcome. 10.30 a.m.
	Afternoon:	Session 1. for papers.
	Evening:	Presidential Address by Dr. H. E. Annett, President of the Royal Institute of Chemistry, N.Z. Branch.
Aug. 28th	Morning:	Session 2. for papers.
	Afternoon:	Visits.
	Evening:	Royal Society Conversazione at Victoria University College.
Aug. 29th	Morning:	Session 3. for papers.
	Afternoon:	General Meeting N.Z.I.C. 2 to 4 p.m.
		„ „ R.I.C. 4.30 to 5.30p.m.
	Evening:	Presidential Address by Dr. J. C. Andrews, President of the New Zealand Institute of Chemistry.
Aug. 30th	Morning:	Session 4. for papers.
	Afternoon:	Visits.

A Meeting of the Council of the New Zealand Institute of Chemistry is scheduled for the afternoon of Aug. 28th.

Further information regarding accommodation will be forwarded to all members and you are asked to complete the

Registration Form and to return it to the CONFERENCE SECRETARY, P.O. Box 250, WELLINGTON before June 20th.

The Conference Committee consists of Dr. J. C. Andrews (Chairman), Dr. J. K. Dixon and W. G. Hughson (Secretary), representing the New Zealand Institute of Chemistry and W. A. Joiner ant M. L. H. Stewart representing the Royal Institute of Cheimistry.

The local Conference Committee consists of J. L. Mandeno (Chairman), D. H. Freeman (Secretary), G. M. Smith (Accommodation), A. J. Metson (Catering) and F. Morgan (Visits).

COUNCIL MEETINGS

February 21st, 1946.

The following decisions were taken by Council:—

(1) Full details are to be obtained of the Government scale of payment for laboratory assistants and the branches are to consider its adoption as an Institute scale.

(2) The principle of admitting Company Members was approved but points raised by branches are to be further investigated.

(3) Branches are to consider the appointment of (a) a General Treasurer and Business Manager of the Journal (b) an Assistant Secretary with no other Institute duties.

(4) Mr. Bishop, (Dept. of Agriculture, Wanganui) and Mr. Fraser, (Plant Chemistry Laboratory), were awarded the Laboratory Assistant's Certificate.

It was decided that Applied Electricity be not included in the list of optional subjects for the Certificate.

(5) Members who intend to remain overseas are to be transferred from branch lists to the list of overseas members.

May 3rd, 1946:

((1) The motion approving the principle of admitting Company Members passed in February, was rescinded.

(2) Further investigation is to be made into the question of a Registrar, instead of the new Honorary Officers referred to in (3) above (February meeting). The President considered that a Registrar is preferable if a suitable man is available.

(3) Branches reported that the Essay Prize has been well advertised at recent meetings. 50 copies of Mr. Fieldes' Essay (1945) have been sent to the Manufacturer's Research Committee for distribution.

(4) The Conference is to be held in Wellington, August 27th—30th. The President considered that the industrial section needed strengthening, and pointed out that papers are not necessarily on original work.

(5) The Wellington Branch is to appoint a sub-committee

on matters relating to the Laboratory Assistant's Certificate.

(6) The list of members is not yet completed.

(7) The Auckland Branch is to set up a sub-committee to consider the question of a Charter.

(8) Sir Theodore Rigg and Professor Soper (Vice President) were authorised to represent the N.Z.I.C. at any Conference of Chemical Institutes of the Empire convened at the time of the Empire Science Conference.

(9) Mrs. D. D. Perrin, and Messrs. P. B. de la Mare and D. D. Perrin were granted leave of absence.

(10) The resignations of Mrs. P. W. Broad and Messrs. R. H. Stokes, M.D. Sutherland and R. Hurst, were accepted with regret.

(11) The death of Mr. Percival Rouse, Otago Branch, was recorded with regret.

(12) Council extends its best wishes to the following members who have recently married:—

Miss E. Broad is now Mrs. R. J. B. Anderson.

Miss M. Wylie is now Mrs. D. G. Coster.

Miss A. W. Tuck is now Mrs. F. D. Collins.

(13) The President reported that he had met the President Secretary and Registrar of the R.I.C. and discussed items of mutual interest to the two Institutes. The R.I.C. is anxious to establish closer contact with Dominion Institutes, and some form of affiliation has been suggested by South Africa. It is hoped that preliminary discussions will be held at the Empire Conference.

Dr. Andrews also discussed the International Union of Chemists with Professor Heilbron and Dr. Lampitt. New Zealand's contribution to this body would be 75 dollars annually for membership. The President considers membership would be valuable.

ELECTION OF FELLOW

At the May Meeting of Council Mr. W. L. M. Dearsley, M.A. (Cantab.), was elected a Fellow of the Institute. Mr. Dearsley was elected an Associate in 1931, when he was Works Manager of the Dominion Compressed Yeast Co., Christchurch. He is now Chief Chemist and in charge of research work for the same Company and has been responsible for the development of new methods for the production of Yeast products. He is well known in executive circles and takes a prominent part in Institute affairs in Christchurch.

ELECTION OF ASSOCIATES

Council has much pleasure in extending a welcome to the following new members who have been elected Associates of the Institute.

G. T. Aitken who graduated M.Sc. in May 1936, is Science Master, Hutt Valley High School.

E. D. Andrews who is a Biochemist to the Agricultural Dept., Wallaceville, took his M.Sc. Degree at Victoria College, in 1934.

R. W. Bailey, M.Sc. is Assistant Chemist to the Dairy Laboratory, Wallaceville.

R. N. Carr, B.Sc. Durham University, England, came to New Zealand to take up the position of Works Manager of International Paints of N.Z. Ltd., Wellington, his experience includes 30 years with International Paint and Compositions Co., London, as Chemist and Works Manager.

D. J. Davis, M.Sc. after occupying temporary positions with the Christchurch Gas Company and Wheat Research Institute went to Australia in June, 1941, as a Chemist to the Munitions Supply Laboratories.

J. W. Dryden took his Bachelor of Science Degree at the University of Otago in 1944 and is now Assistant Chemist to Messrs. Dairy Products Ltd., Edendale.

F. R. Keane, M.Sc., Otago, 1936, spent 2 years in Australia with Messrs. C. P. Curlewis & Co. Pty. Ltd., Sydney, and was a member of the Australian Chemical Institute.

N. P. Lino is Chemist and Assistant Manager of the Pelt Dept. of Messrs. Bailey, Tomkins & Hedges Ltd. He took his B.Sc. Degree in 1942 and is a member of the International Society of Leather Trades Chemists.

J. D. McDonald, M.A. (1929) M.Sc. (1936) from Canterbury College, is Senior Assistant at the Westport Technical High School.

R. B. Miller, M.Sc. Otago, 1944, was for a short time with Messrs. Kempthorne Prosser, Burnside Works, before taking up his present position as Assistant Chemist to the Soil Research Bureau, Wellington.

D. F. Nelson, B.Sc. Otago, 1944, is Assistant Chemist at the Dominion Laboratory, Dunedin.

R. H. Shepherd, M.Sc. Canterbury College, 1941, spent a year as demonstrator in the Chemistry Dept., prior to joining the R.N.Z.N.V.R. where he attained the rank of Lieutenant.

C. L. H. Stonyer, B.Sc. Canterbury College, 1941, spent 4 years with the Munitions Supplies Laboratories, Melbourne and Adelaide prior to taking up his present position with the Vacuum Oil Co. Pty. Ltd., Wellington in May, 1945.

D. U. Strang, M.Sc. Otago, 1933, has also been admitted

to the degrees of Bachelor of Medicine and Bachelor of Surgery, by the University of New Zealand. He was Smeaton Research Scholar in Chemistry 1931-32 at Otago University and holds the Degree if M.R.A.C.P. (Australian College of Physicians).

S. E. Wright, M.Sc. Queensland, 1943, Diploma in Pharmaceutical Science, Sydney, 1935 and an Associate of the Australian Chemical Institute, was recently appointed Principal to the New Zealand College of Pharmacy, Wellington.

BRANCH NOTES

AUCKLAND BRANCH.

The Annual Meeting in November was addressed by Mr. S. R. Siemon who described briefly the constitution of the Australian Chemical Institute emphasising some aspects of the organisation, and activities which might be of interest to members of the N.Z. Institute. The value of a student membership grade was shown by the strength of the student membership, 600 compared with 1,300 corporate members, leading to valuable increase of journal circulation. Such members form the best source of new Associates, e.g., in 1943 of 82 new Associates, 59 were former students. Recently the new grade of Junior (non-corporate) members had been added, the members in that class having the academic standing for Associateship but lacking the necessary practical experience.

In a discussion of activities the value was shown of post-graduate courses sponsored by the Institute, and paid for out of branch funds; of essay competitions for student members; and of library service for country members. The diary published annually is a most attractive and useful article, half paid for by the small number of sixteen advertisements. It contains, as well as information about the A.C.I. and kindred societies, useful data on atomic weights, solvents, steamtable, safety notes, etc.

The monthly journal, besides proceedings and correspondence, contains book reviews, personal notes, items of interest, vacancies for chemists, review articles and original research. The latter portion has become so strong now that it is contemplated splitting the journal into two parts — a monthly journal with proceedings, news etc., and a quarterly containing scientific papers. In recent years the journal has been completely financed by advertisements.

Recently the Institute has been successful in obtaining recognition for A.A.C.I. as a standard of qualification by Public Service Commissioners of States and Commonwealth. The

A.C.I. salary scale for chemists has also been widely adopted by the larger industrial organisations employing chemists. This shows that the A.C.I. has become accepted as the voice of chemists in Australia by employer and government, a position carrying with it responsibilities as well as advantages.

At the end of the address copies of the Journal, Diary and other publications of the A.C.I. were displayed for inspection by members present.

Committee, 1946.

Chairman: R. H. J. Stansfield.
Secretary-Treasurer: S. G. Brooker, P.O. Box 12, Newmarket, Auckland. Committee: B. E. Jackson, P. R. Parr, M. D. Sutherland, A. L. Odell. Auditor: A. J. Parker. Journal Reporter: B. W. Collins. Delegate to Council: R. H. J. Stansfield.

Mr. R. H. J. Stansfield, the newly-elected Chairman of the Auckland Branch, has been a member of the Institute since 1931, and has served a total of seven years on the local committee. Born in Auckland in 1905, Mr. Stansfield was educated at the Seddon Memorial Technical College, where he took the engineering course. After five years' apprenticeship at electrical engineering he took up the study of chemistry at Auckland University College, joining the Auckland Gas Company as assistant chemist in 1927. For the last ten years he has been chief chemist to this company, and in the course of his duties has visited the larger gas-works in both Islands. As was expected with Mr. Stansfield's early training in engineering, his work and interests have by no means been confined to the laboratory, and his wide knowledge of various aspects of the gas industry has been of much assistance in the selection and layout of plant for the extensive reconstructions being undertaken at Auckland.

All chemists, Mr. Stansfield believes, would benefit from visits to works and laboratories outside their own particular industry or institution. In this way their particular outlook and interests would be broadened and stimulated to the undoubted advantage of their work. He hopes that the Institute may be able to assist in this direction by organizing excursions for members.

While a student at Auckland University College Mr. Stansfield published two papers on aspects of organic chemistry in collaboration with Dr. W. F. Short. He also previously lectured to the local branch on the gas industry. Among his hobbies are photography and the raising of a large family. He takes special pride in the fact that his offspring outnumber those of any other Auckland member, even Drs. Andrews and

Briggs being several units behind.

At the first meeting of the 1946 session, on February 26th, two papers were presented. The first, by Mr. W. E. Russell, M.Sc., of the New Zealand Farmers' Fertiliser Co. Ltd., was entitled, "The pH Meter: An Industrial Application." The speaker explained that in England the quantity of acid gases escaping to the atmosphere from a chamber sulphuric acid plant was limited by statute to an equivalent acidity of four grains of sulphur trioxide per cubic foot. In actual fact the gases escaping contained small quantities of sulphur trioxide, sulphur dioxide, nitric oxide and nitrogen peroxide, but for practical purposes these were all calculated as sulphur trioxide. In order therefore to comply with the regulation, and also to reduce losses of nitrogen and sulphur acids and so maintain plant efficiency (an important point in industry), it was necessary to test fairly frequently the exit gases from the final Gay Lussac tower. In the standard method a sample of gas was aspirated with the Fletcher bellows and allowed to remain in contact with hydrogen peroxide solution for a period of 20 minutes. The amount of acid in the peroxide solution was then determined by titration with standard alkali. The method was slow, however, and difficulty was experienced in the determination of the end-point. Mr. Russell then described the apparatus developed in his laboratory for the scrubbing of the gas sample and the determination of the pH of the absorbing solution, and the means adopted for converting this value to grains of sulphur dioxide per cubic foot of gas. Graphs were shown of the results obtained in practice by both the titration and pH methods. The latter enabled measurements to be taken every 20 or 30 minutes, and so supplied much more information to the plant operator than the few determinations at much longer intervals that could be performed using the longer and more cumbrous titration method.

The second speaker was Mr. J. B. Brown, M.Sc., of the Auckland Hospital Laboratory, who described "Some Micro Analytical Methods." The main uses of microchemistry in medicine, said Mr. Brown, were in medico-legal work and as an aid to the clinician in his diagnosis of cases and in order to follow the course of treatment. As an example of the latter type he instanced the blood tests often required on new-born babies, e.g. those of diabetic mothers. Working on 0.05 cc. of blood taken from a puncture of the heel it was possible to follow blood-sugar values from birth, and the child was given appropriate treatment until all danger was passed. The mortality rate among babies of diabetic mothers had dropped considerably since this procedure had been adopted. In general the amounts of sugar present in blood were small, results being

usually expressed in milligrams per 100 cc., i.e. of the order of 0.01%. Colour development and comparison with standards in a colorimeter was the most favoured technique though micro-titration was still commonly used.

Microchemical methods in the solution of a typical medico-legal problem were then discussed in greater detail by Mr. Brown. The case was one of suspected murder, and the question was whether some dried organic material on a handkerchief found on a road was brain tissue. Using a piece of dried brain found nearby for comparison, quantitive tests were made for phosphorus, cholesterol and protein, and also for the blood-clotting enzyme thromboplastin. Only about 20 milligrams of the material from the handkerchief were available for examination. It was nevertheless conclusively proved that the material was not brain tissue, but the nitrogen and cholesterol contents pointed to its being some other body tissue or excretion. Had there been a further 20 mg. of material available, said the speaker, he felt sure that additional microchemical tests would have indicated its source. He concluded by expressing his thanks to Dr. W. Gilmour, head of the Pathological Department of the Hospital, for permission to present the paper.

PERSONAL.

Congratulations to:—

Mr. M. D. Sutherland, late of the Dominion Laboratory, on his appointment as lecturer in organic chemistry in the University of Queensland, Brisbane, Australia; and Mr. R. H. Stokes, late of the Colonial Ammunition Company, who has been appointed lecturer in physical chemistry at the University of Western Australia, Midland, Perth.

Mr. W. E. Russell, N.Z. Farmers' Fertiliser Co. Ltd., replaces Mr. M. D. Sutherland on the branch committee.

Mr. Gordon Stace, of the Dominion Laboratory, also joins the branch committee in place of Mr. A. L. Odell, who has resigned.

Dr. J. C. Andrews, works manager of the Challenge Phosphate Co., and president of the Institute, has recently returned to New Zealand after several months overseas.

Dr. Andrews has been elected a Fellow of the Royal Institute of Chemistry.

WELLINGTON BRANCH

Committee, 1946.

Chairman, J. L. Mandeno; Secretary, N. P. Alcorn, Dominion Laboratory; Committee, E. S. Borthwick, N. T. Clare, D. J. Fraser, J. N. Sutherland; Branch Editor, E. S. Borthwick; Hon. Auditor, G. A. Lawrence.

The Branch Chairman for 1946, Mr. J. L. Mandeno, was educated at the Auckland Grammar School, where he gained a Junior University Scholarship, and subsequent to joining the staff of the Dominion Laboratory as a Cadet in 1929, graduated M.Sc. from V.U.C. in 1933. Initially he was engaged in general analytical work, and later spent several years investigating problems relating to the gas storage of apples.

His activities were then transferred to work in connection with building materials, and in 1944 he was sent overseas on behalf of the D.S.I.R. to study current research in this field, visiting Great Britain, Canada and the United States during a period of some 15 months. Several months of this time were spent at the Building Research Station of the D.S.I.R. at Watford, England, and in the other countries mentioned. Experience was gained through visits to many Universities and research institutions.

Mr. Mandeno's address was entitled, "The Chemist in the Building Industry."

The building industry is generally considered to be the field of the architect, the structural engineer and the builder, but as civilisation has advanced, new conceptions have arisen and new materials have been developed, instead of the continued use of the traditional trial and error methods, it has been necessary to enlist the aid of the chemist and the physicist in the application of scientific principles within the industry.

The speaker dealt with building material under three main headings:—

1. Structural materials whose chief purpose is the provision of strength and the exclusion of the elements.
2. Materials whose main function is to provide a pleasing appearance, and
3. Materials used for the preservation of other materials.

In the first class come materials such as natural stone, brick, concrete, timber etc, and where these materials are used on the exterior of a building, a major requirement is resistance to moisture. It is fair to say that a large proportion of the work of the Building Research Station at Watford, England, has been the study of the interaction between water in its various states and such materials.

In a wall wet on the outside and dry on the inside, water tends to be transferred to the inside part by capillary forces and partly by a distilling action, and with the traditional thick wall it was merely the time factor which kept the inside from showing dampness. With the modern thin wall, however, moisture can penetrate it in a comparatively short time, and one of the best known means for the exclusion of moisture is the use of the cavity wall; as the air in the cavity is probably

never stagnant, the evaporation rate is greater than the rate of distillation, and so both the cavity and the inner wall remain dry.

Moisture absorption is directly bound up with frost resistance, and in porous materials, planes of weakness are formed by the forces of ice formation operating perpendicularly to the surface. Moisture content bears an inverse relationship to strength, and another property of considerable practical importance is the change in volume with changing moisture content; an effect of the latter phenomenon is sometimes seen in the buckling of certain wallboards in humid weather.

By the use of addition agents to cements and concrete, it is possible to improve or modify particular properties; examples are the use of calcium chloride to accelerate setting, and of air-entraining agents, which, although they tend to reduce the strength of concrete by introducing more air voids, increase its durability and workability. Typical of the latter agents are "Vinsol", a resin obtained from pine stumps, and "Darex", a triethanolamine salt of a sulphonated hydrocarbon. Other recent minor additions to cement are grinding agents such as salicylates, which effect considerable power savings in the mills, and wetting and dispersing agents such as sulphated fatty alcohols and naphthalene sulphonic acid derivatives respectively.

Two interesting new materials which also come under the first class above, are wood-wool/cement slabs which may be used for walls, and sawdust/cement flooring which is being laid experimentally in England. Not all woods are suitable for use in this way, however, as some hardwoods such as oak, elm, birch, beech and ash retard or completely inhibit the setting of portland cement.

Dealing with the second class of materials, the speaker said that these could be divided in the main into paints and plasters, but as the former had been dealt with fully in a recent symposium he would confine his remarks to the latter. Plasters for exterior work are usually based on portland cement and sand as a 1.3 mix, sometimes with the addition of about 10% of lime with the cement to provide better workability under the trowel. On the Continent the cracked and crazed renderings so common in England (and in N.Z. too) are practically unknown. There the mixes used vary widely in composition, but almost invariably include a proportion of lime. Tests in England over a period of 5 or 6 years have shown a 1:1:6 cement-lime-sand mix to be the most satisfactory. Our general method of application of renderings is by laying on with a trowel and finishing with a wood or steel float, but on the Continent the plaster is thrown on at a fairly wet consistency

and finished, by various scraping methods, but never by trowelling.

For interior plasters, lime is the basic ingredient, but it is being rapidly replaced by calcium sulphate, the latter material is available in a wide range, from the simple, rapid-setting plaster of paris to the retarded plasters in the so-called hemihydrate or $CaSO_4$, $\frac{1}{2}H_2O$ group. The setting of calcium sulphate plasters is a very complex subject and has not been completely worked out yet; even the traditional lime has not been completely understood by the chemist, its thixotropic properties when made up into a putty still provide a field for investigation as yet lightly touched upon.

Turning to the third class of materials, the lecturer said that once again he proposed not to discuss paint, but to refer to other preservative substances. The main building material in this country is, and will continue to be, timber, and as sapwood is being used more and more in place of the dwindling supplies of heartwood, methods of timber preservation are of major importance. Insect attack, rather than fungal attack, is our main problem, and although many claims are made for toxic agents on the market, claims mostly based on overseas tests, it is fair to say that we have not yet sufficient information to make any statement about the effectiveness and the amount of preservative required to give protection against insect attack. It is true, however, that treatment with any toxic agent is better than no treatment at all. The best known agent, of course, is creosote, whose toxicity depends upon phenolic compounds; up to the present no better preservative has been discovered. Obvious objections to its use for dwelling houses result in its main use being for treating telegraph poles, railway sleepers, marine timbers, fence posts etc.

Of the oil soluble preservatives, the best known are pentachlorophenol and copper naphthenate, these being usually dissolved in fuel oil or kerosene; chlorinated naphthalenes dissolved in petroleum solvents are also used against insect attack.

Water soluble preservatives include zinc chloride and "Wolman" salts (sodium fluoride, dinitrophenol, sodium arsenate, and sodium dichromate), "Celcure" (copper sulphate and sodium dichromate), "Ascu" (copper sulphate, arsenic and a dichromate), and "Chromel" (mercuric chloride, potassium dichromate and sodium nitrate). Chromates and dichromates fix the preservative in the timber so that it cannot be leached out, possibly by the formation of insoluble co-ordination compounds. Distinct possibilities seem to exist also for the new insecticides such as D.D.T. and Gammexane.

Wide publicity has been given to plastics, particularly in

reference to the plastic house; the plastics industry itself has been concerned about the position and has done all it can to refute these wild statements, because although plastics have a definite place in building materials, their use will be limited to such articles as plastic impregnated woods, wallboards and mouldings, miscellaneous fittings, and probably most important of all, for plywood glues.

PERSONAL.

The good wishes of the Branch for a speedy recovery are extended to Mr. E. Pain who had the misfortune to fracture an arm and both ankles as a result of a fall in November last. We hope he will be sufficiently recovered to attend our first meeting of the year.

Mr. and Mrs. Perrin, of Wallaceville, are on the eve of their departure for England to further their studies, and the Branch wishes them every success in the future.

Since returning from service with the Forces, Mr. H. Loeb joined the Dominion Laboratory Staff.

Formerly with Messrs. Sharlands, Auckland, Mr. W. McGillivray has taken the post of Assistant Lecturer in Biochemistry at Massey Agricultural College.

Mr. R. L. Dunn has been appointed Director of the N.Z. Pottery and Ceramics Research Association.

Two well known members of the Dominion Laboratory Staff have tendered their resignations; Mr. G. S. Lambert has accepted a position in Auckland with Messrs. F. Hayes Metal Refiners Ltd., and Mr. M. Fieldes has been appointed Technical Adviser to Messrs. Watson Victor Ltd., Wellington.

CANTERBURY BRANCH.

Committee, 1946.

Chairman, R. J. McIlroy; Secretary, F. H. G. Johnstone, Dominion Compressed Yeast Co.; Committee, A. F. Adams, W. L. M. Dearsley, F. J. T. Grigg, H. V. Rowe; Delegate, F. H. G. Johnstone; Hon. Auditor, G. D. Law.

Dr. R. J. McIlroy, the chairman for 1946 is a graduate of Victoria University College and of the University of Birmingham. After graduating he spent some years on research work of a somewhat varied character; one year at the Dairy Research Institute on problems of cheese quality, two in the Chemical Laboratory, Dept. of Agriculture, Wellington, on plant chemistry and trace elements, and two at Birmingham under the direction of W. N. Haworth, F.R.S., on the constitution of carbohydrates and of lignin leading to the Doctorate of Philosophy. At Birmingham, Dr. McIlroy held the

Chidlaw Post Graduate Research Scholarship in Science of that University. In 1941 he was appointed to a lectureship at C.U.C. where he is now Senior Lecturer in Organic Chemistry. His publications embrace inorganic chemistry, dairy chemistry, agricultural chemistry, and fundamental organic chemistry but his special interest is in the field of carbohydrate chemistry.

The Chairman's address was on "Freedom in Science." The necessity for freedom of speech and publication is generally recognised in democratic countries in time of peace if not under the stress of war. Free enquiry, the right to work on the subject of one's choice is not so widely recognised. It is necessary to counter the propaganda of those who would organise and direct research along lines which they believe will yield results of practical value. Waldemar Kaempffert, in the New York Times of 22/7/45 wrote, "This country (U.S.A.) showed it could mobilize science and plan research for war. There is no reason why it should not similarly mobilize and plan research for peace, without departing from democratic principles; . . . . . no reason why it should not first map out the whole field of science to reveal gaps in our knowledge and see to it that science is developed nationally in every field." The speaker did not agree with this view. Because science is concerned with the making of discoveries and not with the application of already existing discoveries, it is unpredictable and can not be planned. Much industrial research is capable of being planned. Nevertheless the wise director of an industrial laboratory makes some provision for and encourages pure research and spontaneous discovery. Too much organisation may hamper scientific advances. In industrial and government laboratories there is a natural tendency towards routine work and work from which immediate results may be expected. There is sometimes a reluctance on the part of the director of the laboratory to delegate any of his authority. When under such direction, the scientific worker has little or no share in the interpretation and application of his results, and thus becomes a technician he soon loses interest and his work becomes no more than a means of earning a living.

The Universities and some research institutes are the centres of basic research, the search for truth which extends the frontier of knowledge. Dr. Bush, Director of the Office of Scientific Research and Development for the U.S. Government stated, "Scientific research on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown. Freedom of enquiry must be preserved under any plan for Government support of science." The Vice Chancellor of Sheffield University, Dr. J. I. Orme

Masson said, "In time of peace to insist, as various people have tried to do of late years, that the active curiosities of original minds shall be turned aside to topics selected by non-practitioners or lay-arbiters as bearing on current public problems; to constrain into 'practical' themes men of highly specific abilities, whose reason for living hard and (by newspaper standards) inconspicuous lives is that they crave to know certain sorts of unknown things and can endure the long process of finding out; all this is a kind of regimentation which would frustrate its own ends."

Scientists have something in common with artists, musicians and poets in that they are driven by a creative urge. They are fundamentally different from administrators and business men. Methods of business organisation should not be introduced into science. We would not expect a poet to produce a poem on a specific subject to order. Yet there are many who would tell scientists along what lines they may or may not work and what they should discover.

After outlining the organisation of research in the U.S.S.R. as described by J. G. Crowther, the speaker quoted Crowther, an advocate of planning, as reporting that "the scientific researches of persons disapproved by the political authorities have sometimes been omitted from lists of references, and scientists have sometimes been seen apologising to the political authorities for having held opinions which appear to the majority of scientists in the world to be correct."

Finally Dr. Mellroy criticised the lack of funds for University research in New Zealand. It is true that management of the funds is in the hands of the leader of the workers who actually do the research. But funds are always insufficient, and departmental heads who have spent their most creative years in under-equipped and under-staffed laboratories, tend to become reconciled to the present state of affairs and reluctant to make what might appear to the councils to be extravagant claims for increased expenditure. Scientific institutions draw their personnel from the universities, which should be adequately financed, and the productivity of its research workers, who should be a stimulating example to future scientists, should be assisted by improved facilities.

OTAGO BRANCH.

Committee, 1946.

Chairman, D. A. Dick; Secretary, T. H. Kennedy, Medical School; Committee, E. Gregory, O. H. Keys, S. N. Slater; Delegate, S. N. Slater.

Mr. David A. Dick, chairman of the Otago Branch for 1946 was educated at Timaru Boy's High School and Canterbury College, completing M.Sc. in 1930.

He spent some years in investigation and development work with several small manufacturing concerns, mainly on food chemistry, and for the past 8 years has been with the Dunedin Brewery and Wilson Malt Extract Coy. as chemist and later also brewer.

At the March meeting of the Otago Branch of the Institute Mr. D. A. Dick gave the Presidential Address on "Science and Education."

Defining his subject Mr. Dick said he wished to discuss not University education but the education of the great mass of the people. The university student to be of any use to the community should have sufficient intelligence to educate himself whatever the quality of the teaching and further, in a state where the semi educated by virtue of their greater voting power exert more control on our economic and financial system than the university professor, the importance of the intellectual is considerably reduced.

If democracy is to survive as a reasonable method of government it is essential that the masses of the people have the necessary basis of factual knowledge, and understanding of the principles of scientific reasoning only from established facts and not from prejudice, to enable them to exert an intelligent control of the affairs of the world.

It was suggested that such a basis could best be supplied by "more scientific education" in both meanings of the expression — more education in scientific subjects, and a more scientific method of teaching.

Mr. Dick traced briefly the development of our modern system of "free secular and compulsory" education from the early stages when being largely the prerogative of the idle rich it was mainly cultural. Later we have the growth of the opposite extreme, the purely utilitarian technical education of skilled labour. In method there has been a drastic swing of the pendulum from the old idea of control by fear and oppression to the modern cult of freedom of expression. All these methods have virtues as well as faults and have achieved enormous technical and economic progress but the results so far obtained in producing a society which can live in a reasonable state of peace and tolerance have not been very satisfactory.

How far can education influence the child in the direction of intelligent human relationship? There are two broad factors

affecting the development of the child, heredity and environment and the respective importance of each is rather controversial. While heredity may be held responsible for the capabilities or limitations of intellectual development, environment is responsible for the full realization of these capabilities. Certainly there are strong environmental factors outside education such as the radio, picture theatres and the home. The first two of these should to a limited extent be within the control of educational authorities to influence the child on scientific lines in the direction of becoming a reasonable citizen. Home environment is not immediately controllable but insofar as education conditions the mind of the child today so the home environment of tomorrow will be influenced by the teaching of today.

In making any suggestions involving a change in an existing system, four points must be considered.

1. Is the change necessary.

2. Will the proposed change produce the desired result.

3. How can the change be carried out.

4. What are the possible secondary effects of any alteration.

"By their fruits ye shall know them."

At first sight the fruits of past education seem highly satisfactory. We have a highly mechanised age, a high standard of social and economic life, and improved agricultural and transport methods which should remove the fear of starvation — and yet we have seen people starving in a world where food was being destroyed, and along with our scientific methods of production we have more scientific methods of almost incalculable destruction. If this is the product of our educational system it is surely time the scientific workers of the world did something to alter that system, to teach the people to make a more intelligent use of the powers that science has placed at their disposal. Education of the past would appear to have taught the people only enough reading and arithmetic to make them the easy prey of the political opportunist without giving them enough knowledge or reasoning power to analyse and judge, or to see through the impassioned appeals designed only to foster class or national hatreds. Whether "mere scientific education" could produce the desired result may be open to question, but surely the intelligence which could achieve the scientific marvels of the last decade would not find this problem beyond its ability.

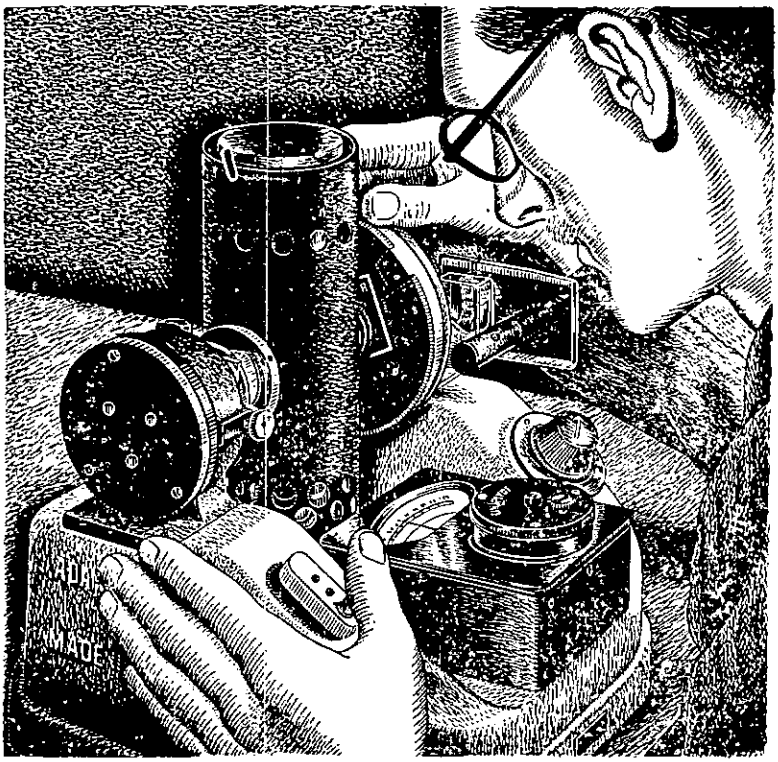
Referring to the last two points mentioned above it is

obvious that more time spent on scientific education must be at the expense of some of the subjects at present being taught, and Mr. Dick maintained that it would be necessary and desirable to sacrifice some of the so called "cultural" subjects, art etc. which are becoming so popular. Perhaps one reason for their popularity is the ease and safety in teaching them — the teacher cannot be found out in a mistake as he is likely to be by some youthful enthusiast on technical or scientific subjects; or perhaps it is just another manifestation of intellectual snobbery.

There is unfortunately among our scientific community a tendency to ignore everything outside their own sphere. It is the duty of those also who have had the privilege and opportunity to develop their intelligence to use those powers for the benefit of the democratic life of the community, and not to let its control fall into the hands of those who lacking knowledge and training can appeal only to prejudice founded on ignorance.

The Presidential Address of the Otago Branch has shown that some Institute members at least are taking an interest in matters other than chemical and fulfilling their duty to the democracy in which we live.

Equipment of an Industry



In the course of its daily work in the service of the community the British chemical industry uses a greater variety of apparatus than any other. This is not surprising since the function of the chemical industry is to help all other industries. Apparatus is needed in the laboratories where research is carried on and the discoveries are made; in the experimental plants where these are tried out; and then in the factories where they are eventually turned over to commercial production. Chemistry is taught in schools and universities, often in well-equipped laboratories, but little is known of the equipment by means of which academic knowledge is harnessed to practical research and production. The present series under the title "Equipment of an Industry" is designed to show some of the instruments and machinery which are used and operated by the men and women of Britain's chemical industry in laboratory and workshop.

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